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TOR-2016-00142

Data Tables Related to TOR-2015-00893

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Abstract

Data tables containing data mined from the AE9/AP9 v1.20.001 mean environment models for near Earth space are presented. The layout of the data table structure is described, and the method of procuring a set of the data tables is given.

Contents

Figures

Tables

1. Introduction

The data tables in this TOR are generated from the AE9/AP9 v1.20.001 model, mean environment mode. They have been validated against the AE9/AP9 model itself and were found to have an error of less than 5% over a one-year span in a static orbit [1].

2. Data Table Structure

The data tables are a series of ASCII tables. They include tables for the trapped particle integral flux spectrum, based on the defaults of the AE9/AP9 v1.20.001 GUI, and dose rate behind a range of shielding depths from 15 mils to 800 mils of aluminum using a silicon target in a spherical geometry. Note that because the ShielDose2 algorithm produces hemispherical geometries, the outputs from the AE9/AP9 dose has been multiplied by 2 in the dose rate data to give a spherical geometry. The data tables available are shown in Table 1.

The data tables are laid out using a geodetic grid of latitudes, longitudes, and altitudes. The latitudes range from -90 to 90 deg in steps of 2 deg. To reduce the file size, any latitudes where there was no data present for that data table were removed. As such, all data tables actually have a maximum range of -86 to 78 deg, with the higher energy data tables typically having fewer latitudes.

The longitudes range from 0 to 360 deg in steps of 5 deg. The data tables contain data at both 0 and 360 deg, though they are equal.

The altitudes range from 0 to 55,000 km with a varying step size. An altitude step of 20 km was used from 0 to 1,500 km, an altitude step of 50 km was used from 1,550 to 5,000 km, and an altitude step of 200 was used beyond 5,200 km. An altitude step of 10 km was used from 35,610 to 36,000 to encapsulate the geosynchronous region. To reduce the file size, any altitudes where there was no data present for that data table were removed.

The ASCII data table files consist of 10 header lines and a body of data. The first line contains the name of the model and the version of that model. The options here are AE9, AP9, or AE9/AP9. These options correspond to the columns in Table 1 with the AE9/AP9 option corresponding to Dose Rate. The dose rate tables were constructed using AE9/AP9's built-in ShielDose2 program.

Table 1. Data Tables Available

AE9 (MeV)	AP9 (MeV)	Dose Rate (Shielding Thickness Mils)
0.04	0.10	15
0.07	0.20	25
0.10	0.40	35
0.25	0.60	50
0.50	0.80	75
0.75	1.00	100
1.00	2.00	150
1.50	4.00	200
2.00	6.00	250
2.50	8.00	300
3.00	10.0	350
3.50	15.0	400
4.00	20.0	450
4.50	30.0	500
5.00	50.0	600
5.50	60.0	700
6.00	80.0	800
6.50	100	
7.00	150	
7.50	200	
8.00	300	
	400	
	700	
	1200	

The second header line contains information about either the integral energy level of the particles fluxes or the shielding thickness of the dose rates in the data table. The third line contains information about the units of the data, which are either particles/cm2/sec for flux tables or rads for dose rate tables. The remainder of the header file contains information about the structure of the grid contained within that data table. The units for latitude, longitude, and altitude are the same for all data files, and so is number of data columns (longitudes). The number of data layers (altitudes) and data rows per layer (latitudes), however, will differ between data tables as some of the altitudes and latitudes will have been removed to remove areas where no data existed.

To reduce the file size, a data cube structure was employed using layers of 2D tables. Each layer of the cube represents one altitude step, with the first row indicating the longitude index and the first column indicating the latitude index. The data is then filled into the remaining body of the table. An example of this data structure is given in Figure 1.

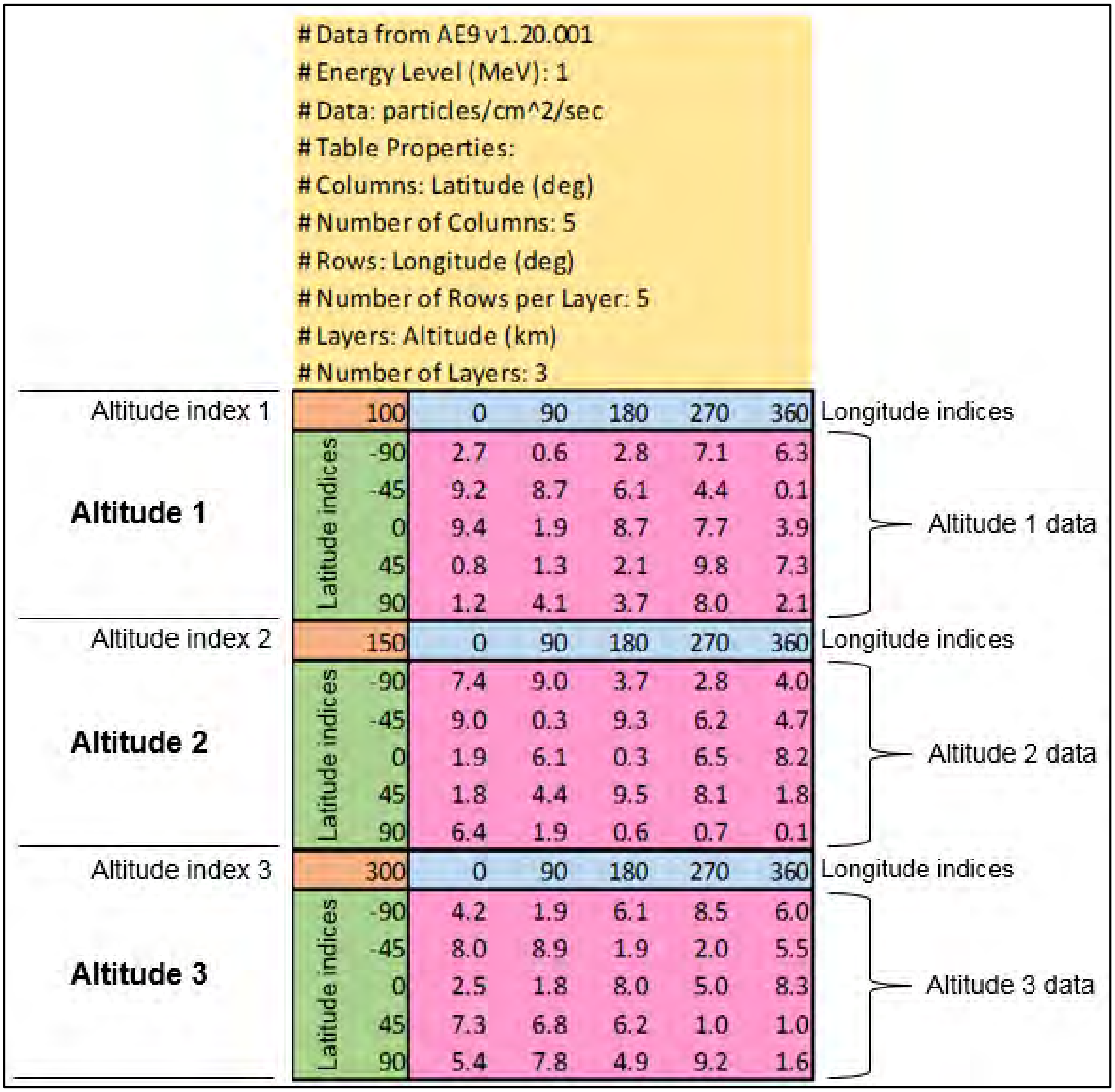

Figure 1. Example data table structure.

3. Obtaining the Data Tables

External to The Aerospace Corporation, the data tables are—or should be—available by logging onto http://www.dtic.mil/dtic/ and searching for this TOR name or number; or by contacting the Aerospace library or the author for a CD. Internally at Aerospace, employees can go to the following link: https://aerolink.aero.org/cs/llisapi.dll?func=ll&objId=36602105&objAction=browse&viewType=1

4. References

1. Davis, J. P. *Generating Lookup Tables from the AE9/AP9 Models*, TOR-2015-00893. The Aerospace Corporation, El Segundo, CA (January 5, 2015).

External Distribution

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